

User Manual

Off Grid Solar Inverter 2KVA-5KVA



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1.0 Information on this Manual

1.1 Validity

This manual is valid for the following devices:

- ▶ SPF 2000TL HVM-24/HVM-48
- ▶ SPF 3000TL HVM-24/HVM-48
- ▶ SPF 4000TL HVM/HVM-P
- ▶ SPF 5000TL HVM/HVM-P
- ▶ SPF 2000TL HVP-24/HVP-48
- ▶ SPF 3000TL HVP-24/HVP-48

1.2 Scope

This manual describes the assembly, installation, operation and troubleshooting of this unit. Please read this manual carefully before installations and operations.

1.3 Target Group

This document is intended for qualified persons and end users. Tasks that do not require any particular qualification can also be performed by end users. Qualified persons must have the following skills:

- ▶ Knowledge of how an inverter works and is operated
- ▶ Training in how to deal with the dangers and risks associated with installing and using electrical devices and installations
- ▶ Training in the installation and commissioning of electrical devices and installations
- ▶ Knowledge of the applicable standards and directives
- ▶ Knowledge of and compliance with this document and all safety information

1.4 Safety instructions






WARNING: This chapter contains important safety and operating instructions. Read and keep this manual for future reference.

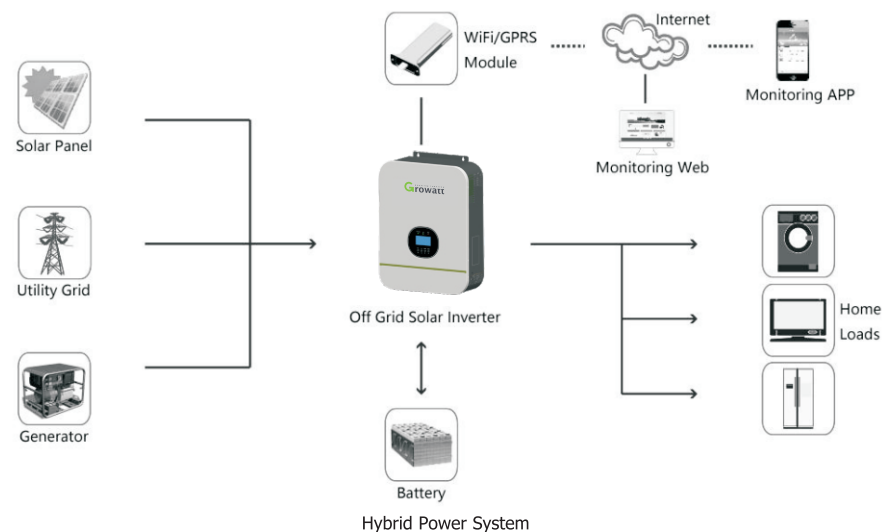
1. **CAUTION** – Only qualified personnel can install this device with battery.
2. Before using the unit, read all instructions and caution marks on the unit, understand the batteries and all appropriate sections of this manual.
3. **NEVER** cause AC output and DC input short circuited. Do NOT connect to the mains when DC input short circuits.
4. **NEVER** charge a frozen battery.
5. Do not disassemble the unit. Take it to a qualified service center when service or repair is required. Incorrect re-assembly may result in a risk of electric shock or fire.
6. To reduce risk of electric shock, disconnect all wiring before attempting any maintenance or cleaning.
7. For optimum operation of this off grid solar inverter, please follow required spec to select appropriate cable size. It's very important to correctly operate this off grid solar inverter.

8. Please strictly follow installation procedure when you want to disconnect AC or DC terminals. Please refer to INSTALLATION section of this manual for the details.
9. GROUNDING INSTRUCTIONS –This off grid solar inverter should be connected to a permanent grounded wiring system. Be sure to comply with local requirements and regulation to install this inverter.
10. Fuses with particular standard are provided as over-current protection for the battery supply.
11. **Warning!!** Only qualified service persons are able to service this device. If errors still persist after following troubleshooting table, please send this off grid solar inverter back to local dealer or service center for maintenance.

1.5 Symbols

Symbol	Explanation
	Indicates a hazardous situation which, if not avoided, can result in machine damage or people injury Refer to page 39
	Indicates a hazardous situation which, if not avoided, can result in machine damage or people injury Refer to page 40
	Indicates overload which, if not avoided, can result in machine damage or people injury Refer to page 39

2.0 Introduction



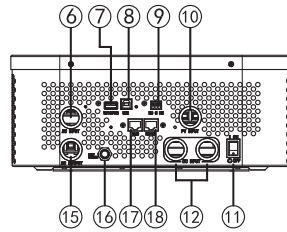
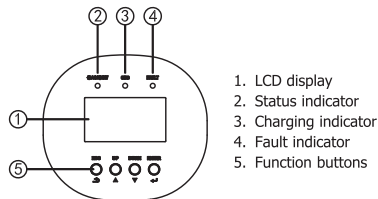
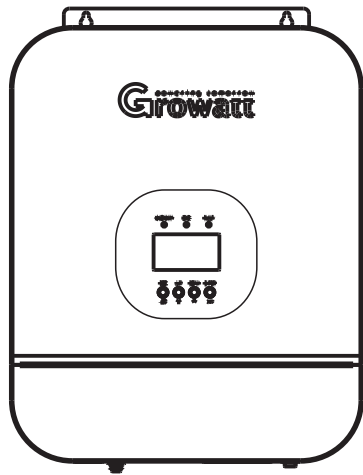
This is a multifunctional off grid solar inverter, integrated with a MPPT/PWM solar charge controller, a high frequency pure sine wave inverter and a UPS function module in one machine, which is perfect for off grid backup power and self-consumption applications. The transformerless design provides reliable power conversion in compact size.

The whole system also need other devices to achieve complete running such as PV modules, generator, or utility grid. Please consult with your system integrator for other possible system architectures depending on your requirements. The WiFi / GPRS module is a plug-and-play monitoring device to be installed on the inverter. With this device, users can monitor the status of the PV system from the mobile phone or from the website anytime anywhere.

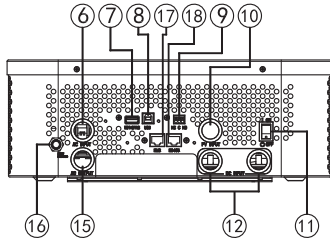
2.1 Features

- ▶ Rated power 2KW to 5KW, power factor 1
- ▶ MPPT solar charge controller / PWM solar charge controller
- ▶ High frequency inverter with small size and light weight
- ▶ Pure sine wave AC output
- ▶ Overload, short circuit and deep discharge protection
- ▶ Configurable AC/ solar input priority via LCD setting
- ▶ Compatible to mains voltage or generator power
- ▶ WIFI/ GPRS remote monitoring (optional)
- ▶ Parallel operation available for 4KW/5KW (optional)

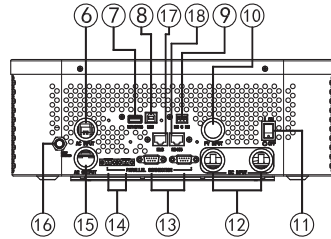
2.2 Product Overview



Single Model (2KVA/3KVA)



Single Model (4KVA/5KVA)



Parallel Model (4KVA/5KVA)

- | | |
|---|---|
| <ul style="list-style-type: none"> 6. AC input 8. USB communication port 10. PV input 12. Battery input 14. Current sharing ports (only for parallel model) 16. Circuit breaker 18. Rs485 communication port (for expansion) | <ul style="list-style-type: none"> 7. WiFi/GPRS communication port 9. Dry contact 11. Power on/off switch 13. Parallel communication ports (only for parallel model) 15. AC output 17. BMS communication port (only supported the RS485 protocol) |
|---|---|

3.0 Installation

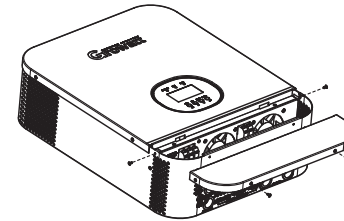
3.1 Unpacking and Inspection

Before installation, please inspect the unit. Be sure that nothing inside the package is damaged. You should have received the following items in the package:

- ▶ The unit x 1
- ▶ User manual x 1
- ▶ USB communication cable x 1
- ▶ Software CD x 1
- ▶ Current sharing cable (parallel model available)
- ▶ Parallel communication cable (parallel model available)

3.2 Preparation

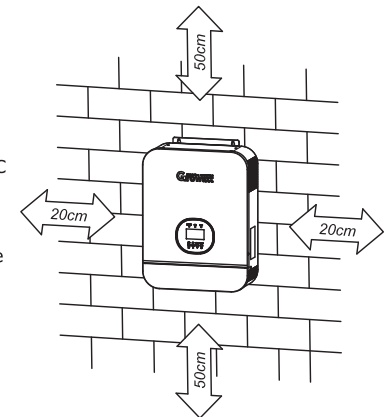
Before connecting all wiring, please take off bottom cover by removing two screws as shown below.



3.3 Mounting the Unit

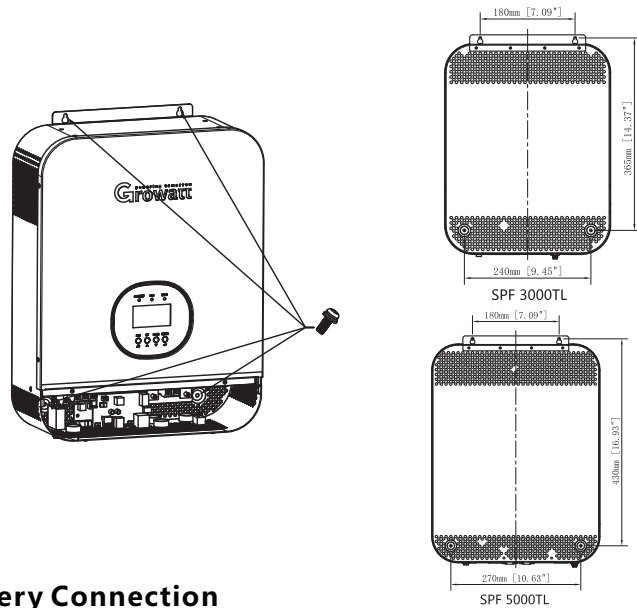
Consider the following points before selecting where to install:

- ▶ Do not mount the inverter on flammable construction materials.
- ▶ Mount on a solid surface
- ▶ Install this inverter at eye level in order to allow the LCD display to be read at all times.
- ▶ The ambient temperature should be between 0°C and 55°C to ensure optimal operation.
- ▶ The recommended installation position is to be adhered to the wall vertically.
- ▶ Be sure to keep other objects and surfaces as shown in the right diagram to guarantee sufficient heat dissipation and to have enough space for removing wires.



⚠ SUITABLE FOR MOUNTING ON CONCRETE OR OTHER NON-COMBUSTIBLE SURFACE ONLY.

Install the unit by screwing three screws. It's recommended to use M4 or M5 screws.



3.4 Battery Connection

3.4.1 Lead acid battery connection

User can choose proper capacity lead acid battery with a nominal voltage at 48V for 48V model and at 24V for 24V model. You need to choose battery type as "AGM (default) or FLD".

CAUTION: For safety operation and regulation compliance, it's requested to install a separate DC over-current protector or disconnect device between battery and inverter. It may not be requested to have a disconnect device in some applications, however, it's still requested to have over-current protection installed. Please refer to typical amperage in below table as required fuse or breaker size.

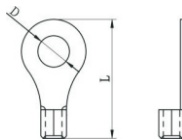
WARNING! All wiring must be performed by a qualified person.

WARNING! It's very important for system safety and efficient operation to use appropriate cable for battery connection. To reduce risk of injury, please use the proper recommended cable and terminal size as below.

Recommended battery cable and terminal size:

Model (48V)	Max. Amp	Bat.Cap	Wire Size	Ring Terminal Dimensions			Torque value
				Cable mm ²	D (mm)	L (mm)	
SPF 2000TL	55A	100AH	1*6AWG	14	6.4	29.2	2~ 3 Nm
			2*10AWG	8	6.4	23.8	
SPF 3000TL	82A	100AH 200AH	1*4AWG	22	6.4	33.2	2~ 3 Nm
			2*8AWG	14	6.4	29.2	
SPF 4000TL	110A	200AH	1*4AWG	22	6.4	39.2	2~ 3 Nm
			2*8AWG	16	6.4	33.2	
SPF 5000TL	137A	200AH	1*2AWG	38	6.4	39.2	2~ 3 Nm
			2*6AWG	28	6.4	33.2	

Ring terminal:

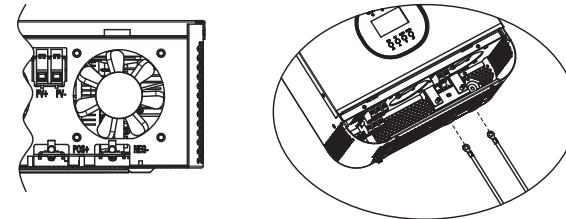


Model (24V)	Max. Amp	Bat.Cap	Wire Size	Ring Terminal Dimensions			Torque value
				Cable mm ²	D (mm)	L (mm)	
SPF 2000TL	109A	100AH	1*4AWG	22	6.4	29.2	2~ 3 Nm
			2*8AWG	16	6.4	23.8	
SPF 3000TL	164A	100AH 200AH	1*2AWG	38	6.4	33.2	2~ 3 Nm
			2*6AWG	28	6.4	29.2	

Note: for lead acid battery, the recommended charge current is 0.2C(C-battery capacity)

Please follow below steps to implement battery connection:

1. Assemble battery ring terminal based on recommended battery cable and terminal size.
2. Connect all battery packs as units requires. It's suggested to connect at least 100Ah capacity battery for 1-3KVA model and at least 200Ah capacity battery for 4KVA/5KVA model.
3. Insert the ring terminal of battery cable flatly into battery connector of inverter and make sure the bolts are tightened with torque of 2-3 Nm. Make sure polarity at both the battery and the inverter/charge is correctly connected and ring terminals are tightly screwed to the battery terminals.



WARNING: Shock Hazard
Installation must be performed with care due to high battery voltage in series.

CAUTION!! Do not place anything between the flat part of the inverter terminal and the ring terminal. Otherwise, overheating may occur.
CAUTION!! Do not apply anti-oxidant substance on the terminals before terminals are connected tightly.
CAUTION!! Before making the final DC connection or closing DC breaker/disconnector, be sure positive (+) must be connected to positive (+) and negative (-) must be connected to negative (-).

3.4.2 Lithium battery connection

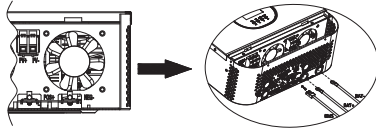
If choosing lithium battery for Growatt SPF series products, you are allowed to use the lithium battery only which we have configured. There're two connectors on the lithium battery, RJ45 port of BMS and power cable.

Please follow below steps to implement lithium battery connection:

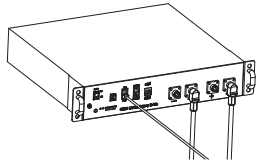
1. Assemble battery ring terminal based on recommended battery cable and terminal size (same as Lead acid, see section 3.4.1 for details) .

2. Insert the ring terminal of battery cable flatly into battery connector of inverter and make sure the bolts are tightened with torque of 2-3Nm. Make sure polarity at both the battery and the inverter/charge is correctly connected and ring terminals are tightly screwed to the battery terminals.

3. Connect the end of RJ45 of battery to BMS communication port of inverter.



4. The other end of RJ45 insert to battery comm port.



Note: if choosing lithium battery, make sure to connect the BMS communication cable between the battery and the inverter. You need to choose battery type as "lithium battery"

3.4.3 Lithium battery communication and setting

In order to communicate with battery BMS, you should set the battery type to "LI" in Program 5. Then the LCD will switch to Program 36, which is to set the protocol type. There are four RS485 protocols in the inverter. Basic protocol Protocol 1 is defined by Growatt. Protocol 2, Protocol 3 and protocol 4 are other customized protocols. Any questions about communicating with BMS, please consult with Growatt.

1. Connect the end of RJ45 of battery to BMS communication port of inverter

Make sure the lithium battery BMS port connects to the inverter is Pin to Pin, the inverter BMS port pin assignment shown as below:

Pin number	BMS port
1	RS485B
2	RS485A
3	--
4	--
5	--
6	--
7	--
8	--



2. LCD setting

To connect battery BMS, need to set the battery type as "LI" in Program 05. After set "LI" in Program 05, it will switch to Program 36 to choose battery type. There will be 4 options under Program 36.

05	Battery type	AGM (default)	FLDd 05
		Flooded	FLDd 05
		Lithium (only suitable when communicated with BMS)	LI 05
		User-Defined	USE 05
If "User-Defined" is selected, battery charge voltage and low DC cut-off voltage can be set up in program 19, 20 and 21.			

36	Protocol to communicate with battery BMS	Protocol 1	PtC LI 1 36
		Protocol 2	PtC LI 2 36
		Protocol 3	PtC LI 3 36
		Protocol 4	PtC LI 4 36

When the battery type set to Li, the setting option 12, 13, 21 will change to display percent.

Note: When the battery type set as "LI", the Maximum charge current can't be modified by the user. When the communication fail, the inverter will cut off output.

12	Setting SOC point back to utility source when selecting "SBU priority" or "Solar first" in program 01	50% 12 Default 50%, 20%~50% Settable
13	Setting SOC point back to battery mode when selecting "SBU priority" or "Solar first" in program 01	95% 13 Default 95%, 60%~100% Settable

21	Low DC cut-off soc. If Li is selected in program 5, this program can be set up	COV 20% 21 Default 20%, 5%~30% Settable
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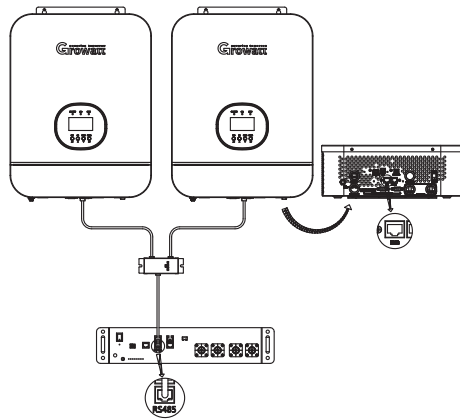
3.4.4 Communicating with battery BMS in parallel system

If need to use communicate with BMS in a parallel system, an external RS485/CAN HUB is needed to converge the communication cables from the parallel inverters to lithium battery.

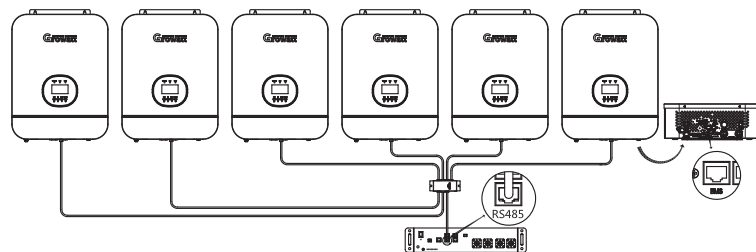
RS485/CAN Hub:



Two inverters in parallel (single phase):



Six inverters in parallel (single phase):



Note: If inverters parallel as 3 phase system, only need to connect L1-Phase inverters with lithium battery to communicate with BMS. When inverters on L1-Phase are more than 2 units, it would need an extra RS485/CAN HUB to converge inverters on L1-Phase to connect with lithium battery to communicate with BMS.

3.5 AC Input/Output Connection

CAUTION!! Before connecting to AC input power source, please install a **separate** AC breaker between inverter and AC input power source. This will ensure the inverter can be securely disconnected during maintenance and fully protected from over current of AC input. The recommended spec of AC breaker is 20A for 2KVA, 32A for 3KVA, 40A for 4KVA and 50A for 5KVA.

CAUTION!! There are two terminal blocks with "IN" and "OUT" markings. Please do NOT mis-connect input and output connectors.

WARNING! All wiring must be performed by a qualified personnel.

WARNING! It's very important for system safety and efficient operation to use appropriate cable for AC input connection. To reduce risk of injury, please use the proper recommended cable size as below.

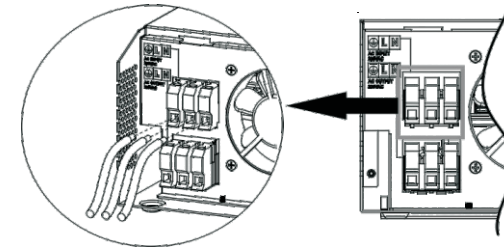
Suggested cable requirement for AC wires

Model(230V)	Gauge	Torque Value
SPF 2000TL	14 AWG	0.8~ 1.0 Nm
SPF 3000TL	12 AWG	1.2~ 1.6 Nm
SPF 4000TL	10 AWG	1.4~ 1.6Nm
SPF 5000TL	8 AWG	1.4~ 1.6Nm

Please follow below steps to implement AC input/output connection:

1. Before making AC input/output connection, be sure to open DC protector or disconnecter first.
2. Remove insulation sleeve 10mm for six conductors. And shorten phase L and neutral conductor N 3mm.
3. Insert AC input wires according to polarities indicated on terminal block and tighten the terminal screws. Be sure to connect PE protective conductor first.

→ **Ground (yellow-green)**
L → **LINE (brown or black)**
N → **Neutral (blue)**

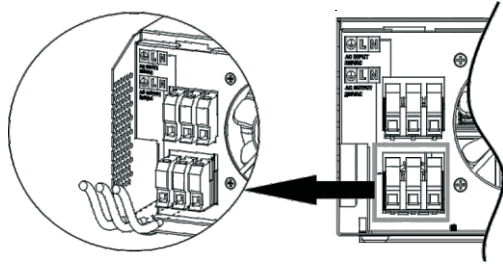


WARNING:

Be sure that AC power source is disconnected before attempting to hardwire it to the unit.

4. Then, insert AC output wires according to polarities indicated on terminal block and tighten terminal screws. Be sure to connect PE protective conductor first.

→ **Ground (yellow-green)**
L → **LINE (brown or black)**
N → **Neutral (blue)**



5. Make sure the wires are securely connected.

CAUTION: Important

Be sure to connect AC wires with correct polarity. If L and N wires are connected reversely, it may cause utility short-circuited when these inverters are worked in parallel operation.

CAUTION: Appliances such as air conditioner are required at least 2~3 minutes to restart because it's required to have enough time to balance refrigerant gas inside of circuits. If a power shortage occurs and recovers in a short time, it will cause damage to your connected appliances. To prevent this kind of damage, please check with manufacturer of air conditioner that if it's equipped with time-delay function before installation. Otherwise, this off grid solar inverter will trigger overload fault and cut off output to protect your appliance but sometimes it still causes internal damage to the air conditioner.

3.6 PV Connection

CAUTION: Before connecting to PV modules, please install **separately** a DC circuit breaker between inverter and PV modules.

WARNING! All wiring must be performed by a qualified personnel.

WARNING! It's very important for system safety and efficient operation to use appropriate cable for PV module connection. To reduce risk of injury, please use the proper recommended cable size as below.

Model (MPPT)	Typical Amperage	Cable Size	Torque
SPF 2000TL/ SPF 3000TL 24Vdc	50A	8 AWG	1.4~1.6 Nm
SPF 2000TL/ SPF 3000TL 48Vdc	30A	10AWG	1.4~1.6 Nm
SPF 4000TL SPF 5000TL	80A	6 AWG	1.4~1.6 Nm

Model (PWM)	Typical Amperage	Cable Size	Torque
SPF 2000TL SPF 3000TL	50A	8 AWG	1.4~1.6 Nm

PV Module Selection:

When selecting proper PV modules, please be sure to consider below parameters:

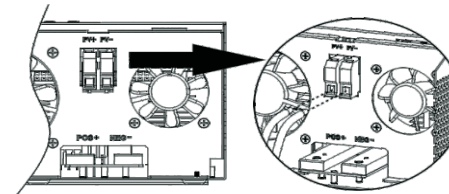
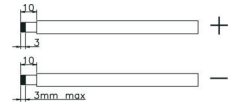
1. Open circuit Voltage (Voc) of PV modules not exceeds max. PV array open circuit voltage of inverter.
2. Open circuit Voltage (Voc) of PV modules should be higher than min. battery voltage.

Solar Charging Mode (MPPT)		
INVERTER MODEL	SPF 2000TL SPF 3000TL	SPF 4000TL SPF 5000TL
Battery Voltage	24V	48V
Max. PV Array Open Circuit Voltage	102Vdc max	145 Vdc max
PV Array MPPT Voltage Range	30~80Vdc	60~115Vdc
Min. battery voltage for PV charge	17Vdc	34Vdc

Solar Charging Mode (PWM)		
INVERTER MODEL	SPF 2000TL / SPF 3000TL (@24VDC)	SPF 2000TL / SPF 3000TL (@48VDC)
Max. PV Array Open Circuit Voltage	60Vdc max	90Vdc max
PV Array PWM Voltage Range	30~32Vdc	60~64Vdc
Min. battery voltage for PV charge	17Vdc	34Vdc

Please follow below steps to implement PV module connection:

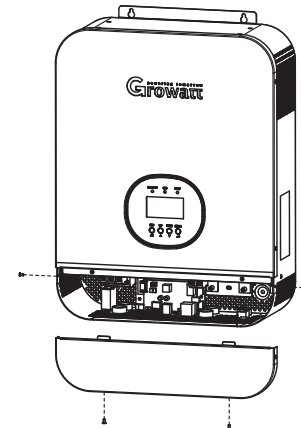
1. Remove insulation sleeve 10 mm for positive and negative conductors.
2. Check correct polarity of connection cable from PV modules and PV input connectors. Then, connect positive pole (+) of connection cable to positive pole (+) of PV input connector. Connect negative pole (-) of connection cable to negative pole (-) of PV input connector.



3. Make sure the wires are securely connected.

3.7 Final Assembly

After connecting all wiring, please put bottom cover back by screwing two screws as shown below.




3.8 Communication Connection

Please use supplied communication cable to connect to inverter and PC. Insert bundled CD into a computer and follow on-screen instruction to install the monitoring software. For the detailed software operation, please check user manual of software inside of CD.


3.9 Dry Contact Signal

There is one dry contact (3A/250VAC) available on the rear panel. When program 24 is set as "disable", it could be used to deliver signal to external device when battery voltage reaches warning level. When program 24 is set as "enable" and the unit is working in battery mode, it could be used to trigger the grounding box to connect neutral and grounding of AC output together.

When program 24 is set as "disable" (default setting):

Unit Status	Condition		Dry contact port:  NC C NO		
			NC & C	NO & C	
Power Off	Unit is off and no output is powered.		Close	Open	
Power On	Output is powered from Utility.		Close	Open	
	Output is powered from Battery or Solar.	Program 01 set as Utility	Battery voltage < Low DC warning voltage	Open	Close
			Battery voltage > Setting value in Program 13 or battery charging reaches floating stage	Close	Open
	Program 01 is set as SBU or Solar first	Program 01 is set as SBU or Solar first	Battery voltage < Setting value in Program 12	Open	Close
Battery voltage > Setting value in Program 13 or battery charging reaches floating stage			Close	Open	

When program 24 is set as "enable":

Unit Status	Condition		Dry contact port:  NC C NO	
			NC & C	NO & C
Power Off	Unit is off and no output is powered.		Close	Open
Power On	Unit works in standby mode, line mode or fault mode		Close	Open
	Unit works in battery mode or power saving mode		Open	Close

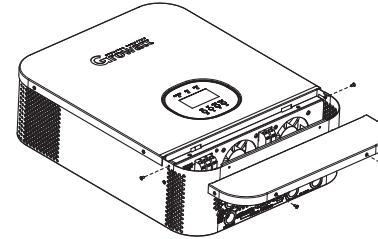
3.10 Parallel installation(Only 4KVA/5KVA available)

3.10.1 Parallel board installation

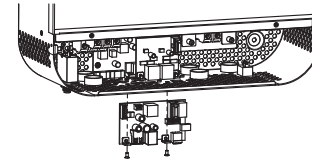
(Following steps just for some customers have installed the inverter, but later need to increase the parallel connection function, so need install the parallel board by themselves)

This installation steps are only applied to 4KVA/5KVA model

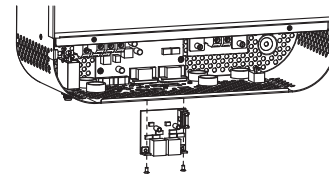
Step 1: Remove wire cover by unscrewing all screws.



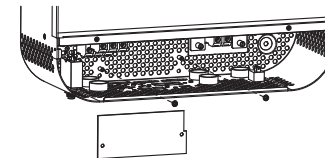
Step 2: Remove communication board by unscrewing two screws as below chart.



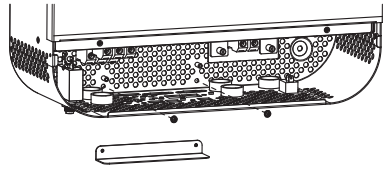
Step 3: Remove Rs485 communication board by unscrewing two screws as below chart.



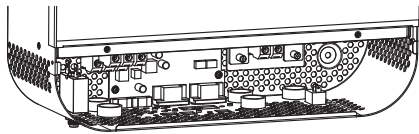
Step 4: Remove two screws as below chart and remove 2-pin and 14-pin cables. Take out the board under the communication board.



Step 5: Remove two screws as below chart to take out cover of parallel communication.



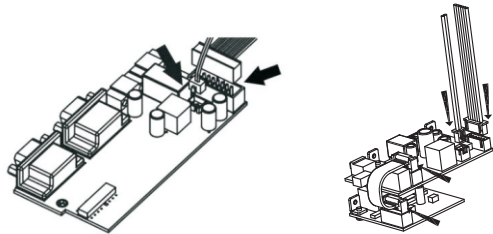
Step 6: Install new parallel board with 2 screws tightly.



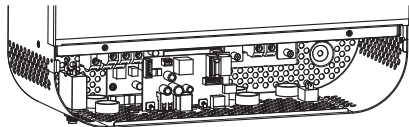
Step 7: Re-connect 2-pin and 14-pin to original position.

Parallel board

Communication board



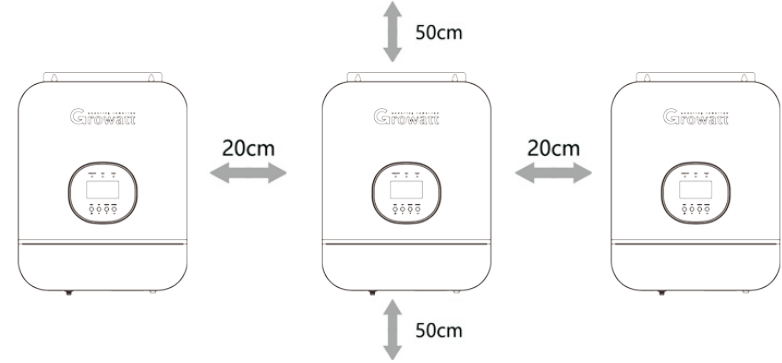
Step 8: Put communication board back to the unit.



Step 9: Put wire cover back to the unit. Now the inverter is providing parallel operation function.

3.10.2 Mounting the Unit

When installing multiple units, please follow below chart.



NOTE: For proper air circulation to dissipate heat, allow a clearance of approx. 20cm to the side and 50 cm above and below the unit. Be sure to install each unit in the same level.

3.10.3 Parallel Operation in Single phase (Only 4KVA/5KVA available)

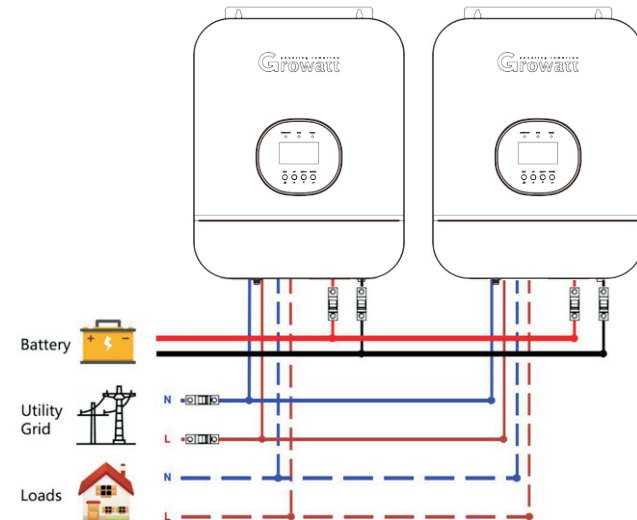


WARNING:

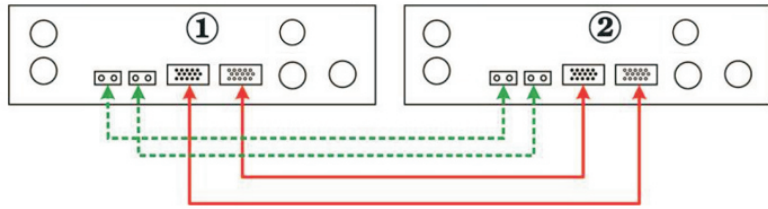
All inverters must be connected to the same batteries and ensure each group of cables from the inverters to the batteries in the same length.

2 inverters in parallel:

Power Connection

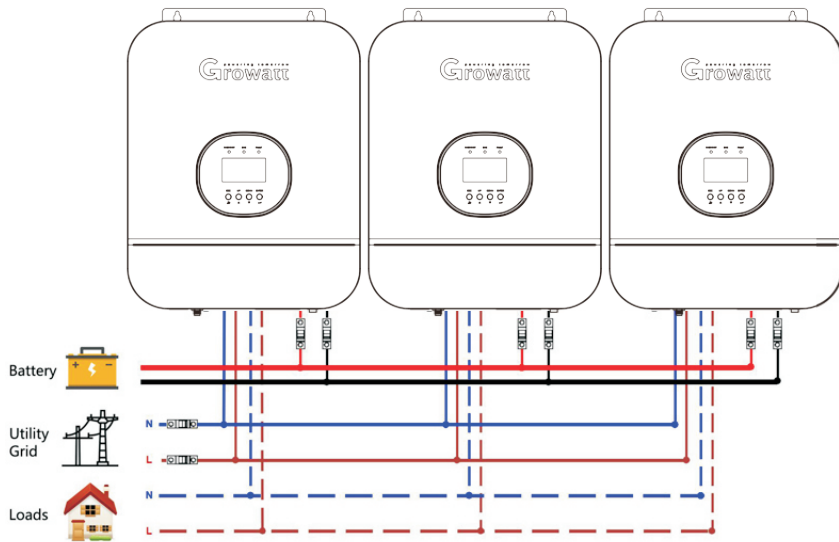


Communication Connection

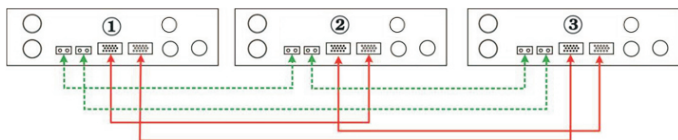


3 inverters in parallel:

Power Connection

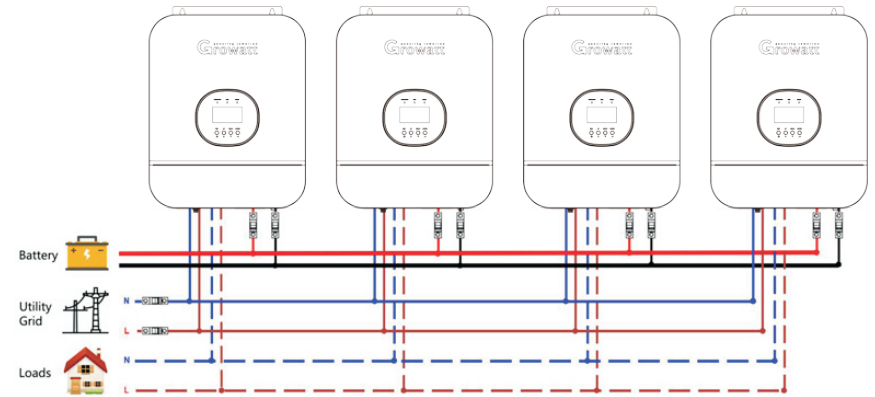


Communication Connection

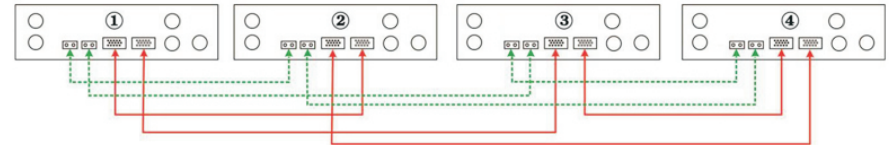


4 inverters in parallel:

Power Connection

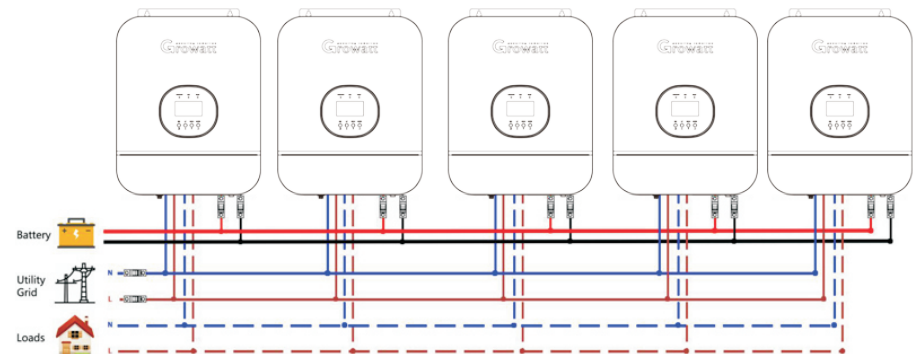


Communication Connection

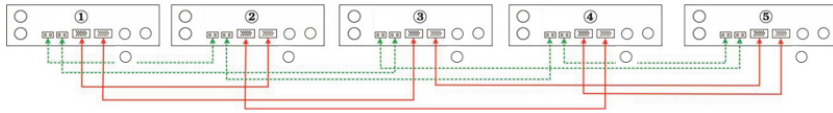


5 inverters in parallel:

Power Connection



Communication Connection

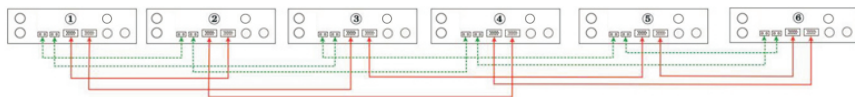


6 inverters in parallel:

Power Connection



Communication Connection



3.10.4 Parallel Commissioning

Parallel in single phase

Step 1: Check the following requirements before commissioning:

- Correct wire connection
- Ensure all breakers in Line wires of load side are open and each Neutral wires of each unit are connected together.

Step 2: Turn on each unit and set "PAL" in LCD setting program 23 of each unit. And then shut down all units

NOET: It's necessary to turn off switch when setting LCD program. Otherwise, the setting can not be programmed.

Step 3: Turn on each unit.

LCD display in Master unit	LCD display in Slave unit

NOTE: Master and slave units are randomly defined.

Step 4: Switch on all AC breakers of Line wires in AC input. It's better to have all inverters connect to utility at the same time. If not, the AC failed connected inverter will display warning 15.

LCD display in Master unit	LCD display in Slave unit

Step 5: If there is no more fault alarm, the parallel system is completely installed.

Step 6: Please switch on all breakers of Line wires in load side. This system will start to provide power to the load.

3.10.5 Parallel operation in three phase (Only 4KVA/5KVA available)



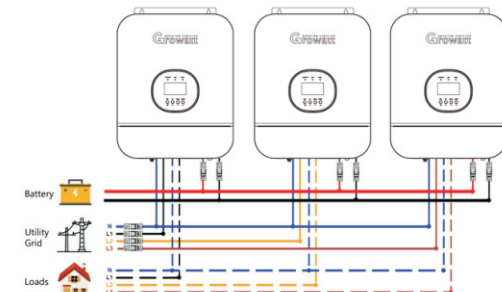
WARNING:

All inverters must be connected to the same batteries and ensure each group of cables from the inverters to the batteries in the same length.

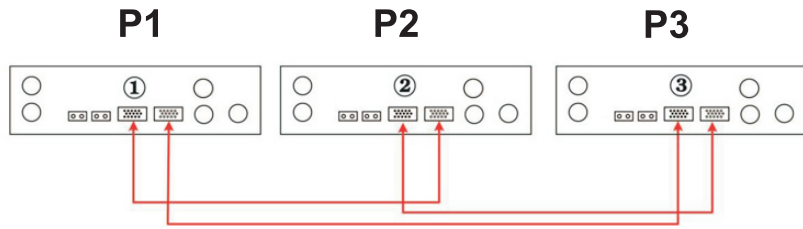
3 inverters group three phase

one inverter in each phase:

Power Connection



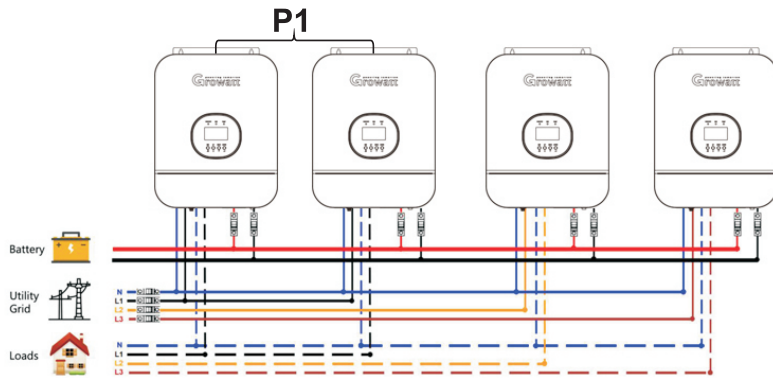
Communication Connection



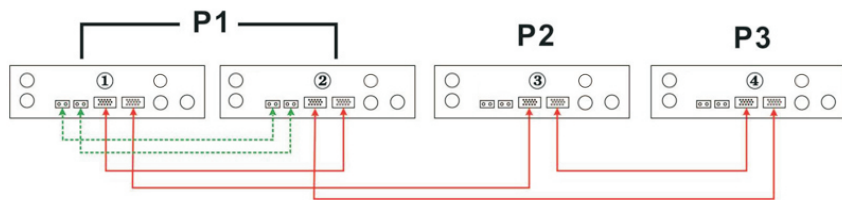
4 inverters group three phase

Two inverter in one phase and only one inverter for the remaining phases:

Power Connection



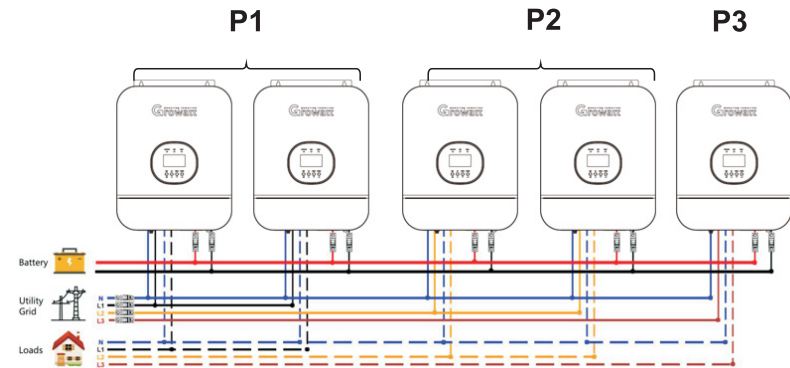
Communication Connection



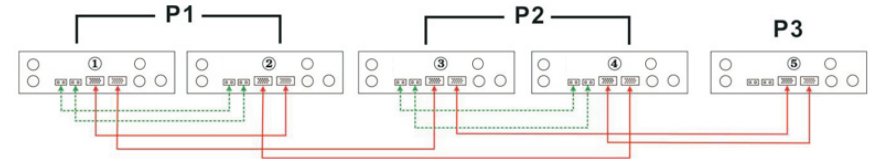
5 inverters group three phase

Type 1: Two inverters in two phases and only one inverter for the remaining phase:

Power Connection

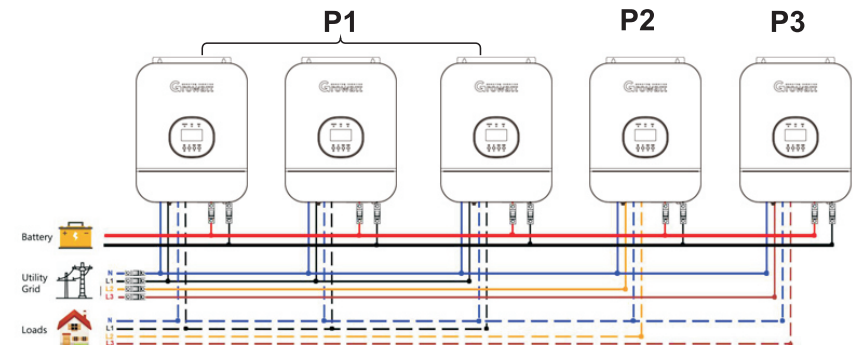


Communication Connection

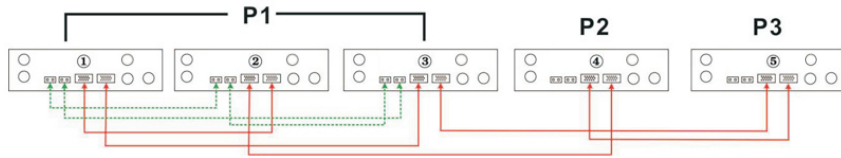


Type 2: Three inverters in one phase and only one inverter for the remaining two phases:

Power Connection



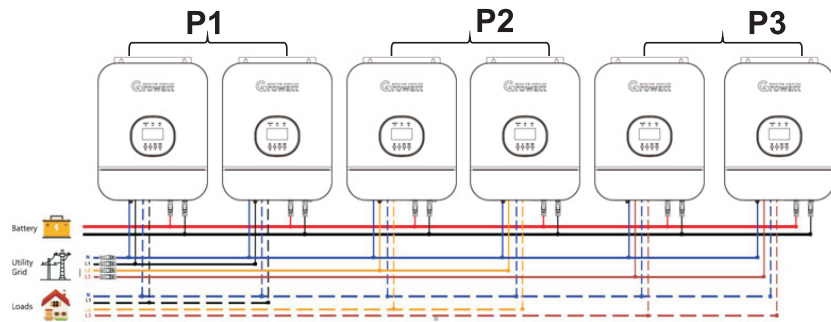
Communication Connection



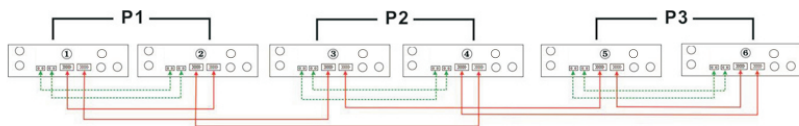
6 inverters group three phase

Type 1: Two inverters in each phase:

Power Connection

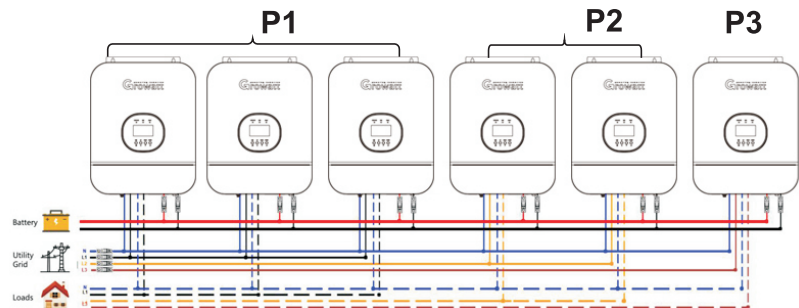


Communication Connection

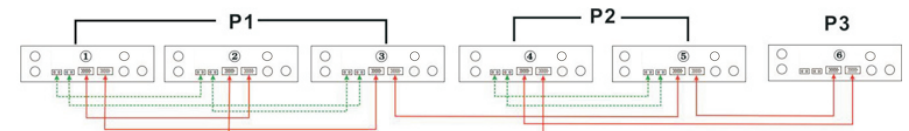


Type 2: Three inverters in one phase, two inverters in second phase and one inverter for the third phase:

Power Connection

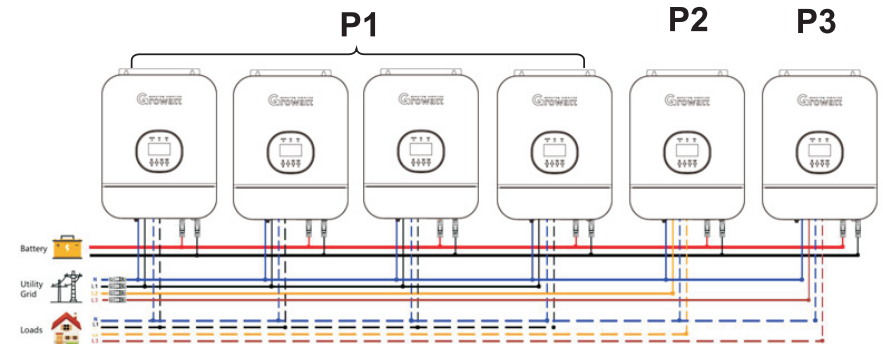


Communication Connection

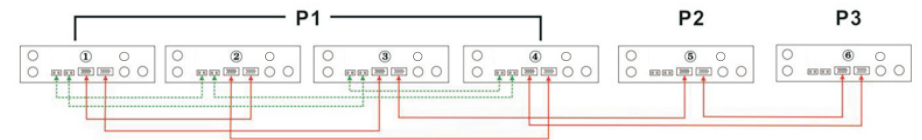


Type 3: Four inverters in one phase and one inverter for the other two phases:

Power Connection



Communication Connection



WARNING: Do not connect the current sharing cable between the inverters which are in different phases.

Otherwise, it may damage the inverters.

3.10.6 Support three-phase equipment

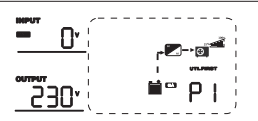
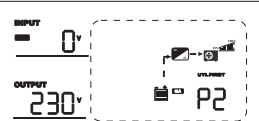
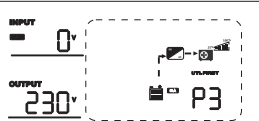
Step 1: Check the following requirements before commissioning:

- Correct wire connection
- Ensure all breakers in Line wires of load side are open and each Neutral wires of each unit are connected together.

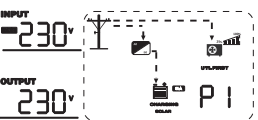
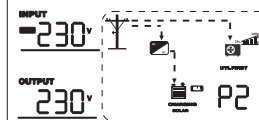
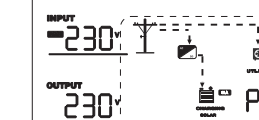
Step 2: Turn on all units and configure LCD program 23 as P1, P2 and P3 sequentially. Then shut down all units.

NOTE: It's necessary to turn off switch when setting LCD program. Otherwise, the setting can not be programmed.

Step 3: Turn on all units sequentially.

LCD display in L1-phase unit	LCD display in L2-phase unit	LCD display in L3-phase unit
		

Step 4: Switch on all AC breakers of Line wires in AC input. If AC connection is detected and three phases are matched with unit setting, they will work normally. If not, the AC failed connected inverter will display warning

LCD display in L1-phase unit	LCD display in L2-phase unit	LCD display in L3-phase unit
		

Step 5: If there is no more fault alarm, the system to support 3-phase equipment is completely installed.

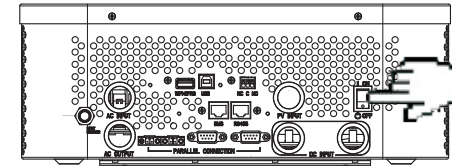
Step 6: Please switch on all breakers of Line wires in load side. This system will start to provide power to the load.

Note 1: To avoid overload occurring, before turning on breakers in load side, it's better to have whole system in operation first.

Note 2: Transfer time for this operation exists. Power interruption may happen to critical devices, which cannot bear transfer time.

4.0 Operation

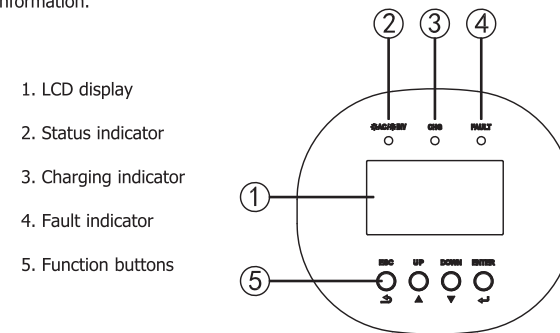
4.1 Power ON/OFF



Once the unit has been properly installed and the batteries are connected well, simply press On/Off switch (located on the button of the case) to turn on the unit.

4.2 Operation and Display Panel

The operation and display panel, shown in below chart, is on the front panel of the inverter. It includes three indicators, four function keys and a LCD display, indicating the operating status and input/output power information.



1. LCD display
2. Status indicator
3. Charging indicator
4. Fault indicator
5. Function buttons

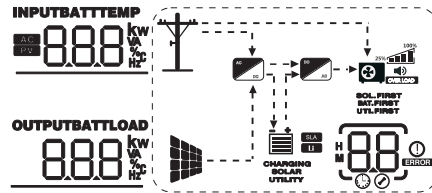
LED Indicator

LED Indicator	LED Indicator	Messages	
☀ AC / ☀ INV	Green	Solid On	Output is powered by utility in Line mode.
	Flashing	Output is powered by battery or PV in battery mode.	
☀ CHG	Green	Solid On	Battery is fully charged.
	Flashing	Battery is charging.	
⚠ FAULT	Red	Solid On	Fault occurs in the inverter.
	Flashing	Warning condition occurs in the inverter.	

Function Buttons

Button	Description
ESC	To exit setting mode
UP	To go to previous selection
DOWN	To go to next selection
ENTER	To confirm the selection in setting mode or enter setting mode

4.2.1 LCD Display Icons



Icon	Function Description	
Input Source Information		
	Indicates the AC input.	
	Indicates the PV input	
INPUT 	Indicate input voltage, input frequency, PV voltage, battery voltage and charger current.	
Configuration Program and Fault Information		
	Indicates the setting programs.	
	Indicates the warning and fault codes.	
	Warning: flashing with warning code.	
	Fault: lighting with fault code	
Output Information		
OUTPUTBATTLOAD 	Indicate output voltage, output frequency, load percent, load in VA, load in Watt and discharging current.	
Battery Information		
	Indicates battery level by 0-24%, 25-49%, 50-74% and 75-100% in battery mode and charging status in line mode.	
	These two signs indicate the charge priority. SOLAR indicates solar first. UTILITY indicate utility first. SOLAR blinking indicates solar only; SOLAR and UTILITY both on indicates combined charging.	
In AC mode, it will present battery charging status.		
Status	Battery voltage	LCD Display
Constant Current mode / Constant Voltage mode	<2V/cell	4 bars will flash in turns.
	2 ~ 2.083V/cell	Bottom bar will be on and the other three bars will flash in turns.
	2.083 ~ 2.167V/cell	Bottom two bars will be on and the other two bars will flash in turns.
	> 2.167 V/cell	Bottom three bars will be on and the top bar will flash.
Floating mode. Batteries are fully charged.		4 bars will be on.

In battery mode, it will present battery capacity.

Load Percentage	Battery Voltage	LCD Display
Load >50%	< 1.717V/cell	
	1.717V/cell ~ 1.8V/cell	
	1.8 ~ 1.883V/cell	
50% > Load > 20%	> 1.883 V/cell	
	< 1.817V/cell	
	1.817V/cell ~ 1.9V/cell	
Load < 20%	1.9 ~ 1.983V/cell	
	> 1.983	
	< 1.867V/cell	
	1.867V/cell ~ 1.95V/cell	
	1.95 ~ 2.033V/cell	
	> 2.033	

Load Information

OVERLOAD	Indicates overload.			
	Indicates the load level by 0-24%, 25-49%, 50-74% and 75-100%.			
	0%~24%	25%~49%	50%~74%	75%~100%

Mode Operation Information

	Indicates unit connects to the mains.
	Indicates unit connects to the PV panel.
BYPASS	Indicates load is supplied by utility power.
	Indicates the utility charger circuit is working.
	Indicates the DC/AC inverter circuit is working.
SOL.FIRST BAT.FIRST UTI.FIRST	These three signs indicate the output priority. SOL.FIRST indicates solar first. BAT.FIRST indicates battery first. UTI.FIRST indicates utility first.

Mute Operation

	Indicates unit alarm is Enabled.
--	----------------------------------

4.2.2 LCD Setting

After pressing and holding ENTER button for 3 seconds, the unit will enter setting mode. Press "UP" or "DOWN" button to select setting programs. And then, press "ENTER" button to confirm the selection or ESC button to exit.

Setting Programs:

Program	Description	Setting Option	
01	Output source priority: To configure load power source priority	Solar first	SOL 01
		Solar energy provides power to the loads as first priority. If solar energy is not sufficient to power all connected loads, battery energy will supply power the loads at the same time. Utility provides power to the loads only when any one condition happens: - Solar energy is not available - Battery voltage drops to either low-level warning voltage or the setting point in program 12.	
		Utility first (default)	UTI 01
		Utility will provide power to the loads as first priority. Solar and battery energy will provide power to the loads only when utility power is not available.	
		SBU priority	SBU 01
Solar energy provides power to the loads as first priority. If solar energy is not sufficient to power all connected loads, battery energy will supply power to the loads at the same time. Utility provides power to the loads only when battery voltage drops to either low-level warning voltage or the setting point in program 12.			
02	Maximum charging current: To configure total charging current for solar and utility chargers. (Max. charging current = utility charging current + solar charging current)	80 [^]	02
48V 5KVA/4KVA model:default 60A, 10A~140A settable 48V 3KVA/2KVA MPPT model:default 30A, 10A~45A settable 48V 3KVA/2KVA PWM model:default 65A, 10A~65A settable 48V 3KVA/2KVA MPPT model:default 60A, 10A~80A settable 24V 3KVA/2KVA PWM model:default 80A, 10A~80A settable (If Li is selected in program 5,this program can't be set up)			
03	AC input voltage range	RPL 03	If selected, acceptable AC input voltage range will be within 90~280VAC
		UPS 03	If selected, acceptable AC input voltage range will be within 170~280VAC
		GEN 03	If selected, acceptable AC input voltage range will be within 90~280VAC

04	Power saving mode enable/disable	SdS 04	If disabled, no matter connected load is low or high, the on/off status of inverter output will not be effected.
		SEn 04	If enabled, the output of inverter will be off when connected load is pretty low or not detected.
05	Battery type	AGM (default)	User-Defined
		AGM 05	If "User-Defined" is selected, battery charge voltage and low DC cut-off voltage can be set up in program 19, 20 and 21.
		FLo 05	
Lithium		LI 05	(Only suitable when communicated with BMS)
06	Auto restart when overload occurs	REd 06	RE 06
07	Auto restart when over temperature occurs	TEd 07	TE 07
08	Output voltage	230V (default)	220V
		230 ^v 08	220 ^v 08
240V		208V	
		240 ^v 08	208 ^v 08
09	Output frequency	50Hz (default)	60Hz
		50 _{Hz} 09	60 _{Hz} 09
10	Number of series batteries connected	BATT nO 4 10 (e.g. Showing batteries are connected in 4 series)	

11	Maximum utility charging current	30 [^] 11 ⊙	48V model: default 30A, 10A~60A Settable(4KVA/5KVA) 24V model: default 20A, 20A~30A Settable(2KVA/3KVA) 48V model: default 10A, 10A~15A Settable(2KVA/3KVA) (If Li is selected in program 5,this program can't be set up)
12	Setting voltage point back to utility source when selecting "SBU priority" or "Solar first" in program 01	46.0 ^v 12 ⊙	48V model: default 46.0V, 44.0V~51.2V Settable 24V model: default 23.0V, 22.0V~25.6V Settable
13	Setting voltage point back to battery mode when selecting "SBU priority" or "Solar first" in program 01	54.0 ^v 13 ⊙	48V model: default 54.0V, 48.0V~58.0V Settable 24V model: default 27.0V, 24.0V~29.0V Settable
14	Charger source priority: To configure charger source priority	If this off grid solar inverter is working in Line, Standby or Fault mode, charger source can be programmed as below:	
		Solar first C50 14 ⊙	Solar energy will charge battery as first priority. Utility will charge battery only when solar energy is not available.
		Utility first CUE 14 ⊙	Utility will charge battery as first priority. Solar energy will charge battery only when utility power is not available.
		Solar and Utility 5NU 14 ⊙	Solar energy and utility will both charge battery.
		Only Solar 050 14 ⊙	Solar energy will be the only charger source no matter utility is available or not.
		If this off grid solar inverter is working in Battery mode or Power saving mode, only solar energy can charge battery. Solar energy will charge battery if it's available and sufficient.	
15	Alarm control	Alarm on (default) 60N 15 ⊙	Alarm off 60F 15 ⊙
16	Backlight control	Backlight on (default) L0N 16 ⊙	Backlight off L0F 16 ⊙

17	Beeps while primary source is interrupted	Alarm on (default) A0N 17 ⊙	Alarm off A0F 17 ⊙
18	Overload bypass: When enabled, the unit will transfer to line mode if overload occurs in battery mode.	Bypass disable (default) bYd 18 ⊙	Bypass enable bYE 18 ⊙
19	Bulk charging voltage (C.V voltage). If self-defined is selected in program 5, this program can be set up	C ^v 56.4 ^v 19 ⊙	48V model: default 56.4V, 48.0V~58.4V Settable 24V model: default 28.2V, 24.0V~29.2V Settable
20	Floating charging voltage. If self-defined is selected in program 5, this program can be set up	FL ^v 54.0 ^v 20 ⊙	48V model: default 54.0V, 48.0V~58.4V Settable 24V model: default 27.0V, 24.0V~29.2V Settable
21	Low DC cut-off voltage. If self-defined is selected in program 5, this program can be set up	C0 ^v 42.0 ^v 21 ⊙	48V model: default 42.0V, 40.0V~48.0V Settable 24V model: default 21.0V, 20.0V~24.0V Settable
22	Solar power balance. When enabled, solar input power will be automatically adjusted according to connected load power. (Only available for 4KVA/5KVA model)	Solar power balance enable (Default): 56E 22 ⊙	If selected, solar input power will be automatically adjusted according to the following formula: Max. input solar power = Max. battery charging power + Connected load power.
		Solar power balance disable: 56d 22 ⊙	If selected, the solar input power will be the same to max. battery charging power no matter how much loads are connected. The max. battery charging power will be based on the setting current in program 2. (Max. solar power = Max. battery charging power)

23	AC output mode *This setting is only available (4KVA/5KVA) when the inverter is in standby mode (Switch off).	Single: OUTPUT <u>SI G</u> 23	When the units are used in parallel with single phase, please select "PAL" in program 23.
		Parallel: OUTPUT <u>PAL</u> 23	It requires 3 inverters to support three-phase equipment, 1 inverter in each phase. Please refers to 5-2 for detailed information. Please select "3P1" in program 23 for the inverters connected to L1 phase, "3P2" in program 23 for the inverters connected to L2 phase and "3P3" in program 23 for the inverters connected to L3 phase.
		L1 phase: OUTPUT <u>3P 1</u> 23	
		L2 phase: OUTPUT <u>3P 2</u> 23	Be sure to connect share current cable to units which are on the same phase. Do NOT connect share current cable between units on different phases. Besides, power saving function will be automatically disabled.
		L3 phase: OUTPUT <u>3P 3</u> 23	
24	Allow neutral and grounding of AC output is connected together: When enabled, inverter can deliver signal to trigger grounding box to short neutral and grounding (for expansion)	Disable: Neutral and grounding of AC output is disconnected. (Default) <u>NEC</u>	This function is only available when the inverter is working with external grounding box. Only when the inverter is working in battery mode, it will trigger grounding box to connect neutral and grounding of AC output.
		<u>dI S</u> 24	
		Enable: Neutral and grounding of AC output is connected. <u>NEC</u>	
		<u>ENA</u> 24	

4.3 Display Information

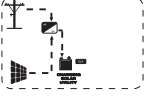


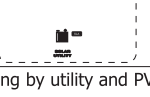



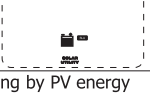
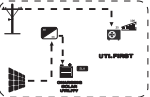
The LCD display information will be switched in turns by pressing "UP" or "DOWN" key. The selectable information is switched as below order: input voltage, input frequency, PV voltage, MPPT charging current, MPPT charging power, battery voltage, output voltage, output frequency, load percentage, load in VA, load in Watt, DC discharging current, main CPU Version and second CPU Version.

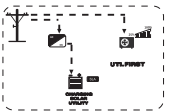
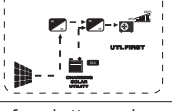

Setting Information	LCD display
Input voltage/Output voltage (Default Display Screen)	Input Voltage=230V, output voltage=230V
Input frequency	Input frequency=50Hz
PV voltage	PV voltage=60V
Charging current	Current ≈ 10A Current < 10A

MPPT Charging power	<p>MPPT charging power=500W</p>
Battery voltage/ DC discharging current	<p>Battery voltage=51.0V, discharging current=0A</p>
Output frequency	<p>Output frequency=50Hz</p>
Load percentage	<p>Load percent=70%</p>
Load in VA	<p>When connected load is lower than 1KVA, load in VA will present xxx VA like below chart.</p> <p>When load is larger than 1KVA ($\geq 1\text{KVA}$), load in VA will present x.xKVA like below chart.</p>




















Load in Watt	<p>When load is lower than 1KW, load in W will present xxx W like below chart.</p> <p>When load is larger than 1KW ($\geq 1\text{KW}$), load in W will present x.x kW like below chart.</p>
Main CPU version checking (For models with PWM controller)	<p>Main CPU version 501-00-716</p>
Main CPU version checking (For models with MPPT controller)	<p>Main CPU version 500-00-719</p>
Secondary CPU version checking (For models with PWM controller)	<p>Secondary CPU version 002-00-719</p>
Secondary CPU version checking (For models with MPPT controller)	<p>Secondary CPU version 002-00-719</p>
Battery SOC	<p>Battery SOC=80%</p>

4.4 Operating Mode Description













Operation mode	Description	LCD display
Standby mode / Power saving mode Note: *Standby mode: The inverter is not turned on yet but at this time, the inverter can charge battery without AC output. *Power saving mode: If enabled, the output of inverter will be off when connected load is pretty low or not detected.	No output is supplied by the unit but it still can charge batteries.	Charging by utility and PV energy. 
		Charging by utility. 
		Charging by PV energy. 
		No charging. 
Fault mode Note: *Fault mode: Errors are caused by inside circuit error or external reasons such as over temperature, output short circuited and so on.	PV energy and utility can charge batteries.	Charging by utility and PV energy. 
		Charging by utility. 
		Charging by PV energy. 
		No charging. 
Line Mode	The unit will provide output power from the mains. It will also charge the battery at line mode.	Charging by PV energy 

Line Mode	The unit will provide output power from the mains. It will also charge the battery at line mode.	Charging by utility 
Battery Mode	The unit will provide output power from battery and PV power.	Power from battery and PV energy. 
		Power from battery only. 















4.5 Fault Reference Code

Fault Code	Fault Event	Icon on
01	Fan is locked	
02	Over temperature	
03	Battery voltage is too high	
04	Battery voltage/soc is too low	
05	Output short circuited is detected by internal converter components.	
06	Output voltage is too high.	
07	Overload time out	
08	Bus voltage is too high	
09	Bus soft start failed	
51	Over current or surge	
52	Bus voltage is too low	
53	Inverter soft start failed	
55	Over DC voltage in AC output	
56	Battery connection is open	
57	Current sensor failed	
58	Output voltage is too low	
60	Negative power fault	
80	CAN fault	
81	Host loss	

4.6 Warning Indicator

Warning Code	Warning Event	Audible Alarm	Icon flashing
01	Fan is locked when inverter is on.	Beep three times every second	
02	Over temperature	Beep once every second	
03	Battery is over-charged	Beep once every second	
04	Low battery	Beep once every second	
07	Overload	Beep once every 0.5 second	
10	Output power derating	Beep twice every 3 seconds	
12	Solar charger stops due to low battery	Beep once every second	
13	Solar charger stops due to high PV voltage	Beep once every second	
14	Solar charger stops due to overload	Beep once every second	
15	Parallel input utility grid different	Beep once every second	
16	Parallel input phase error	Beep once every second	
17	Parallel output phase loss	Beep once every second	

New warning codes after communicating with BMS

Warning code	Warning event	Audio alarm	Icon flashing
20	Bms communication error	Beep once every second	
33	Bms communication loss	Beep once every second	
34	Cell over voltage	Beep once every second	
35	Cell under voltage	Beep once every second	
36	Total over voltage	Beep once every second	
37	Total under voltage	Beep once every second	
38	Discharge over current	Beep once every second	
39	Charge over current	Beep once every second	
40	Discharge over temperature	Beep once every second	
41	Charge over temperature	Beep once every second	
42	Mosfet over temperature	Beep once every second	
43	Battery over temperature	Beep once every second	
44	Battery under temperature	Beep once every second	
45	System shut down	Beep once every second	

5.0 Specifications

Table 1: Line Mode Specifications

INVERTER MODEL	SPF 2000TL	SPF 4000TL
	SPF 3000TL	SPF 5000TL
Input Voltage Waveform	Sinusoidal (utility or generator)	
Nominal Input Voltage	230Vac	
Low Loss Voltage	170Vac±7V (UPS) 90Vac±7V (Appliances)	
Low Loss Return Voltage	180Vac±7V (UPS); 100Vac±7V (Appliances)	
High Loss Voltage	280Vac±7V	
High Loss Return Voltage	270Vac±7V	
Max AC Input Voltage	300Vac	
Nominal Input Frequency	50Hz / 60Hz (Auto detection)	
Low Loss Frequency	40±1Hz	
Low Loss Return Frequency	42±1Hz	
High Loss Frequency	65±1Hz	
High Loss Return Frequency	63±1Hz	
Output Short Circuit Protection	Line mode: Circuit Breaker Battery mode: Electronic Circuits	
Efficiency (Line Mode)	>95% (Rated R load, battery full charged)	
Transfer Time	10ms typical (UPS); 20ms typical (Appliances)	
Output power derating: When AC input voltage drops to 95V or 170V depending on models, the output power will be derated.		

Table 2: Inverter Mode Specifications

INVERTER MODEL	SPF 2000TL SPF 3000TL		SPF 4000TL SPF 5000TL
	Rated Output Power	2KVA/2KW 3KVA/3KW	
Output Voltage Waveform	Pure Sine Wave		
Output Voltage Regulation	230Vac±5%		
Output Frequency	60Hz or 50Hz		
Peak Efficiency	93%		
Overload Protection	5s@≥150% load; 10s@110%~150% load		
Surge Capacity	2* rated power for 5 seconds		
Nominal DC Input Voltage	24Vdc		48Vdc
Cold Start Voltage /Soc	23.0Vdc/30%		46.0Vdc/30%
Low DC Warning Voltage @ load < 20% @ 20% ≤ load < 50% @ load ≥ 50%	22.0Vdc 21.4Vdc 20.2Vdc		44.0Vdc 42.8Vdc 40.4Vdc
Low DC Warning Return Voltage @ load < 20% @ 20% ≤ load < 50% @ load ≥ 50%	23.0Vdc 22.4Vdc 21.2Vdc		46.0Vdc 44.8Vdc 42.4Vdc
Low DC Cut-off Voltage @ load < 20% @ 20% ≤ load < 50% @ load ≥ 50%	21.0Vdc 20.4Vdc 19.2Vdc		42.0Vdc 40.8Vdc 38.4Vdc
Low DC Warning Soc	Low DC Cut-off Soc+5%		
Low DC Warning Return Soc	Low DC Cut-off Soc+10%		
Low DC Cut-off Soc	Default 20%,5%~30% Settable		
High DC Recovery Voltage	29Vdc		58Vdc
High DC Cut-off Voltage	30.4Vdc		60.8Vdc
No Load Power Consumption	<25W	<25W	<50W
Saving Mode Power Consumption	<10W	<10W	<15W

Table 3: Charge Mode Specifications

Utility Charging Mode			
INVERTER MODEL	SPF 2000TL SPF 3000TL	SPF 4000TL SPF 5000TL	
Batty Voltage	24V	48V	
Charging Current (UPS) @ Nominal Input Voltage	20/30A	10/15A	10/20/30/40/50/60A
Bulk Charging Voltage	Flooded Battery	29.2Vdc	58.4Vdc
	AGM / Gel Battery	28.2Vdc	56.4Vdc
Floating Charging Voltage	27Vdc	54Vdc	54Vdc
Overcharge Protection	31Vdc	60Vdc	60Vdc
Charging Algorithm	3-Step		
Charging Curve	<p>The graph plots Battery Voltage (per cell) on the left y-axis and Charging Current (%) on the right y-axis against Time on the x-axis. The voltage curve starts at 2.29Vdc, rises to 2.43Vdc (±0.30Vdc) during the Bulk (Constant Current) phase (T0), remains constant during the Absorption (Constant Voltage) phase (T1), and then gradually declines. The current curve starts at 100% and decreases to 0% over time. T1 is defined as 10 * T0, with a minimum of 10 minutes and a maximum of 8 hours.</p>		

Solar Charging Mode (MPPT)			
INVERTER MODEL	SPF 2000TL SPF 3000TL		SPF 4000TL SPF 5000TL
Efficiency	98.0% max.		
Batty Voltage	24V	48V	
Max. PV Array Open Circuit Voltage	102Vdc	145Vdc	
PV Array MPPT Voltage Range	30~80Vdc	60~115Vdc	
Min Battery Voltage for PV Charge	17Vdc	34Vdc	
Standby Power Consumption	2W		
Battery Voltage Accuracy	+/-0.3%		
PV Voltage Accuracy	+/-2V		
Charging Algorithm	3-Step		
Joint Utility and Solar Charging			
Max Charging Current	80Amp	45Amp	140Amp
Default Charging Current	60Amp	30Amp	60Amp

Solar Charging Mode (PWM)		
INVERTER MODEL	SPF 2000TL	SPF 3000TL
Max. PV Array Open Circuit Voltage	60Vdc (for 24V battery)	90Vdc (for 48V battery)
Best Operating Voltage Range	30~32Vdc	60~64Vdc
Standby Power Consumption	2W	
Battery Voltage Accuracy	+/-0.3%	
PV Voltage Accuracy	+/-2V	
Charging Algorithm	3-Step	
Joint Utility and Solar Charging		
Max Charging Current	80Amp	65Amp
Default Charging Current	80Amp	65Amp

Table 4: General Specifications

INVERTER MODEL	SPF 2000TL SPF 3000TL	SPF 5000TL SPF 4000TL
Safety Certification	CE	
Operating Temperature Range	0°C to 55°C	
Storage Temperature	-15°C~ 60°C	
Humidity	5% to 95% Relative Humidity (Non-condensing)	
Dimension, mm	400 x 315 x 130	455 x 350 x 130
Net Weight, kg	8.5	11.5

6.0 Trouble Shooting

Problem	LCD/LED/Buzzer	Explanation / Possible cause	What to do
Unit shuts down automatically during startup process.	LCD/LEDs and buzzer will be active for 3 seconds and then complete off.	The battery voltage is too low (<1.91V/Cell)	1. Re-charge battery. 2. Replace battery.
No response after power on.	No indication.	1. The battery voltage is far too low. (<1.4V/Cell) 2. Battery polarity is connected reversed.	1. Check if batteries and the wiring are connected well. 2. Re-charge battery. 3. Replace battery.
Mains exist but the unit works in battery mode.	Input voltage is displayed as 0 on the LCD and green LED is flashing.	Input protector is tripped	Check if AC breaker is tripped and AC wiring is connected well.
	Green LED is flashing.	Insufficient quality of AC power. (Shore or Generator)	1. Check if AC wires are too thin and/or too long. 2. Check if generator (if applied) is working well or if input voltage range setting is correct. (UPS Appliance)
	Green LED is flashing.	Set "Solar First" as the priority of output source.	Change output source priority to Utility first.
When the unit is turned on, internal relay is switched on and off repeatedly.	LCD display and LEDs are flashing	Battery is disconnected.	Check if battery wires are connected well.
Buzzer beeps continuously and red LED is on.	Fault code 01	Fan fault	Replace the fan.
	Fault code 02	Internal temperature of component is over 100°C.	Check if the air flow of the unit is blocked or the ambient temperature is too high.
	Fault code 03	Battery is over-charged.	Return to repair center.
		The battery voltage is too high.	Check if spec and quantity of batteries are meet requirements.
	Fault code 05	Output short circuited.	Check if wiring is connected well and remove abnormal load.
	Fault code 06/58	Output abnormal (Inverter voltage below than 190Vac or is higher than 260Vac)	1. Reduce the connected load. 2. Return to repair center
	Fault code 07	Overload error. The inverter is overload 110% and time is up.	Reduce the connected load by switching off some equipment.
	Fault code 08/09/53/57	Internal components failed.	Return to repair center.
	Fault code 51	Over current or surge.	Restart the unit, if the error happens again, please return to repair center.
	Fault code 52	Bus voltage is too low.	
Fault code 55	Output voltage is unbalanced.		
Fault code 56	Battery is not connected well or fuse is burnt.	If the battery is connected well, please return to repair center.	